SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

September 1982
NSRP 0009

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Proceedings of the IREAPS Technical Symposium

Paper No. 14: Computer Integrated Shipbuilding: A Framework for Technology Modernization

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

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Proceedings
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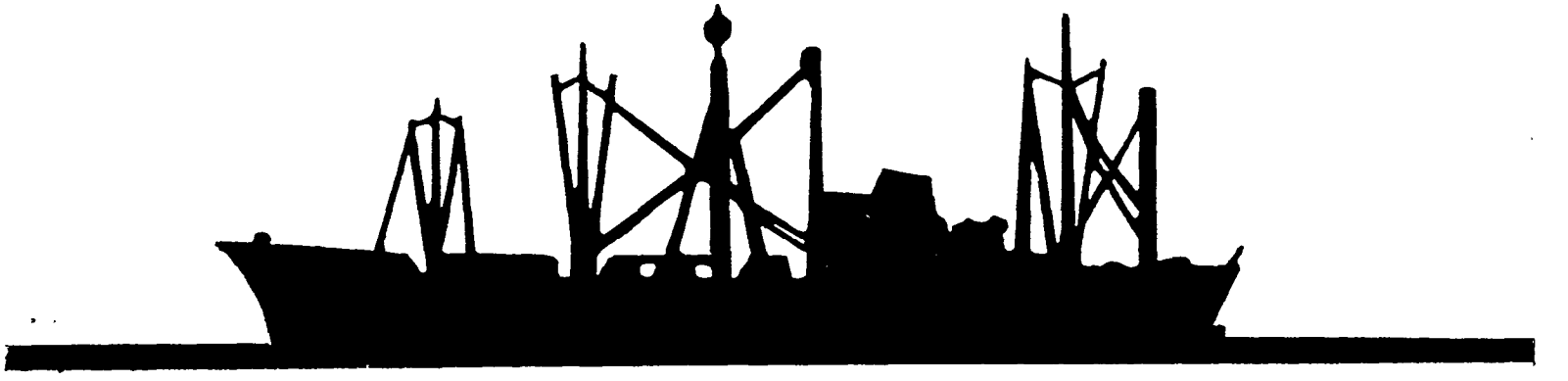
VOLUME I



INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

COMPUTER INTEGRATED SHIPBUILDING: A FRAMEWORK FOR TECHNOLOGY MODERNIZATION

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Senior Associate Consultant
D. Appleton Company Incorporated

Mr. Snodgrass specializes in strategic and tactical management consulting services for advanced CAD/CAM technology with emphasis on program management, capital resources, information resource management and human resource planning. DACOM clients include major corporations and their subcontractors throughout the United States. He has more than 25 years of experience in the manufacturing industry. His experience covers the gamut of manufacturing functions, ranging from product design to "bottom-line" business management. Included in his background is exceptional firsthand experience in such areas as manufacturing engineering, production planning, materials planning, proposal management, and management information systems. Additionally, Mr. Snodgrass has been personally instrumental in introducing advanced state of the art practices into a number of manufacturing environments, including CAD/CAM, Group Technology, and Quality Circles.

Mr. Snodgrass is a Mechnical Engineer and is an Executive Program Graduate of the UCLA Graduate School of Management.

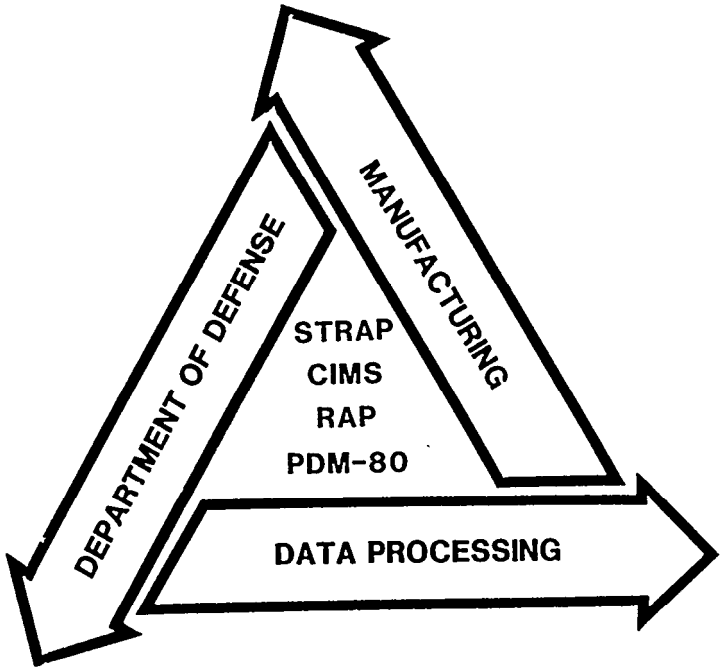
ABSTRACT

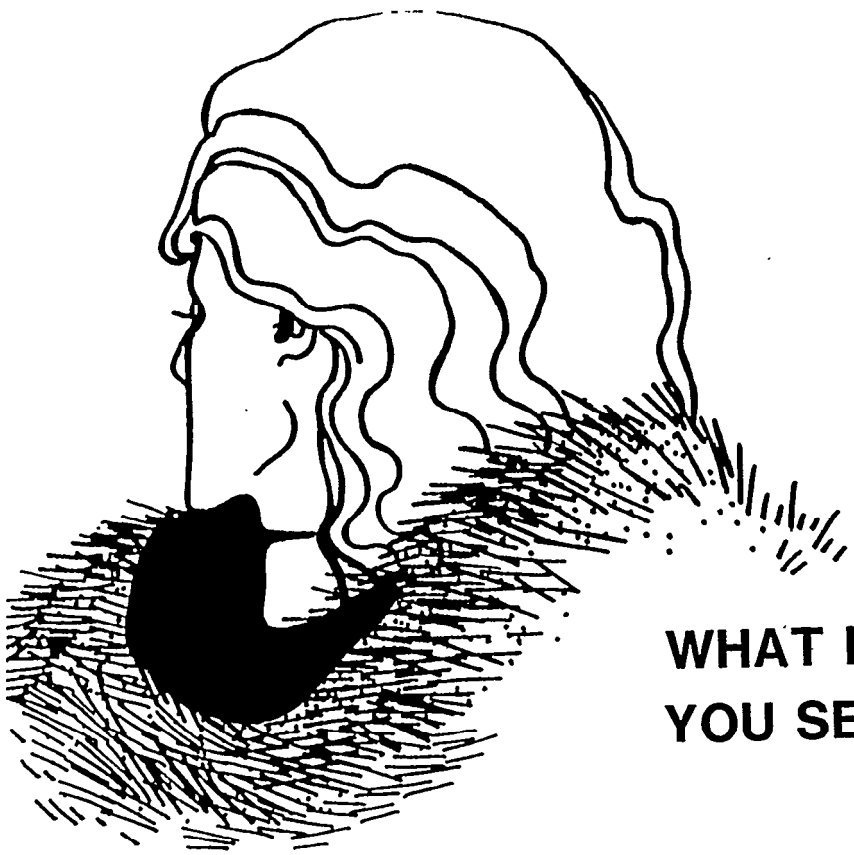
Computer Integrated Shipbuilding (CIS) systems represent a key technology for improving the U.S. shipbuilding industry in the coming decades. CIS will be based upon a completely integrated CAD/CAM system that provides computer control or assistance to all shipbuilding functions. The shipbuilding aspects embraced by CIS include business planning and support, engineering design and ship production planning, control, and automation. All business functions of marketing, ship delivery, and logistics support can be linked into such a CIS system.

The objective of this paper is to provide a framework for shipbuilding technology modernization which incorporates a road map for the integration of shipbuilding functions via systematic planning and the simultaneous systematic application of computer technology.

This CIS approach is unique in that it is data driven and is based upon a three architecture concept. This concept concentrates planning methodologies on building three formal integrated architectures: (1) the "application and database architecture", defining what applications and databases must be implemented to support the using. community; (2) the "computer systems architecture" on which those applications and databases will be implemented; and (3) the "control architecture" which defines specific project and software management techniques to be used to implement and maintain the applications within the computer systems architecture. Each of the architectures is ultimately represented in the form of standards and procedures.

DACOM





WHAT DO YOU SEE?

"CAD/CAM APPLICATIONS IN THE CONSTRUCTION OF NAVAL VESSELS" WORKSHOP

- IDENTIFICATION OF **STP PROGRAM PROBLEMS & OPPORTUNITIES**
- **POTENTIAL TECHNOLOGICAL & MANAGEMENT STRATEGIES**
- **ROLE OF COMPUTERS IN SHIPYARD INFORMATION MANAGEMENT**
- **APPLYING TECHNOLOGIES & ORGANIZATIONAL FORMS FROM OTHER INDUSTRY SECTORS**
- **STRATEGIES FOR DEVELOPING THE NEXT GENERATION OF COMPUTER AIDED SYSTEMS**

COMPUTER INTEGRATED [sl HIPBUILDING

- **COMMON TERMINOLOGY & CONCEPTS**
- **PRODUCTIVITY 'MYTHS" AND "DISCOVERIES"**
- **CHANGING MANAGEMENT FOCUS**
- **INFORMATION RESOURCE MANAGEMENT (IRM)**
- **DATA' DRIVEN IRM ARCHITECTURE**
- **MANAGING CIS FOR TOMORROW**

COMMON TERMINOLOGY

- FRAMEWORK
- ARCHITECTURE
- STRUCTURE
- "BLUE PRINT"
- "ROAD MAP"

COMPUTER INTEGRATED MANUFACTURING

- MANUFACTURING, WHICH BEGINS WITH PRODUCT DESIGN AND ENDS WITH SUPPORT AND MAINTENANCE IN THE FIELD, IS A MONOLITHIC, INDIVISIBLE FUNCTION. --- NO PART CAN BE SUCCESSFULLY CONSIDERED IN ISOLATION FROM ALL OTHER PARTS.

- DIVERSE AS THE VARIOUS PARTS OF MANUFACTURING MAY SEEM, THERE IS A COMMON THREAD THAT RUNS THROUGH THE FULL SCOPE OF ALL MANUFACTURING ACTIVITIES. -- MANUFACTURING IS, IN THE ULTIMATE ANALYSIS, A SERIES OF DATA PROCESSING OPERATIONS,

DR. JOSEPH HARRINGTON
1990 CAD/CAM CONFERENCE

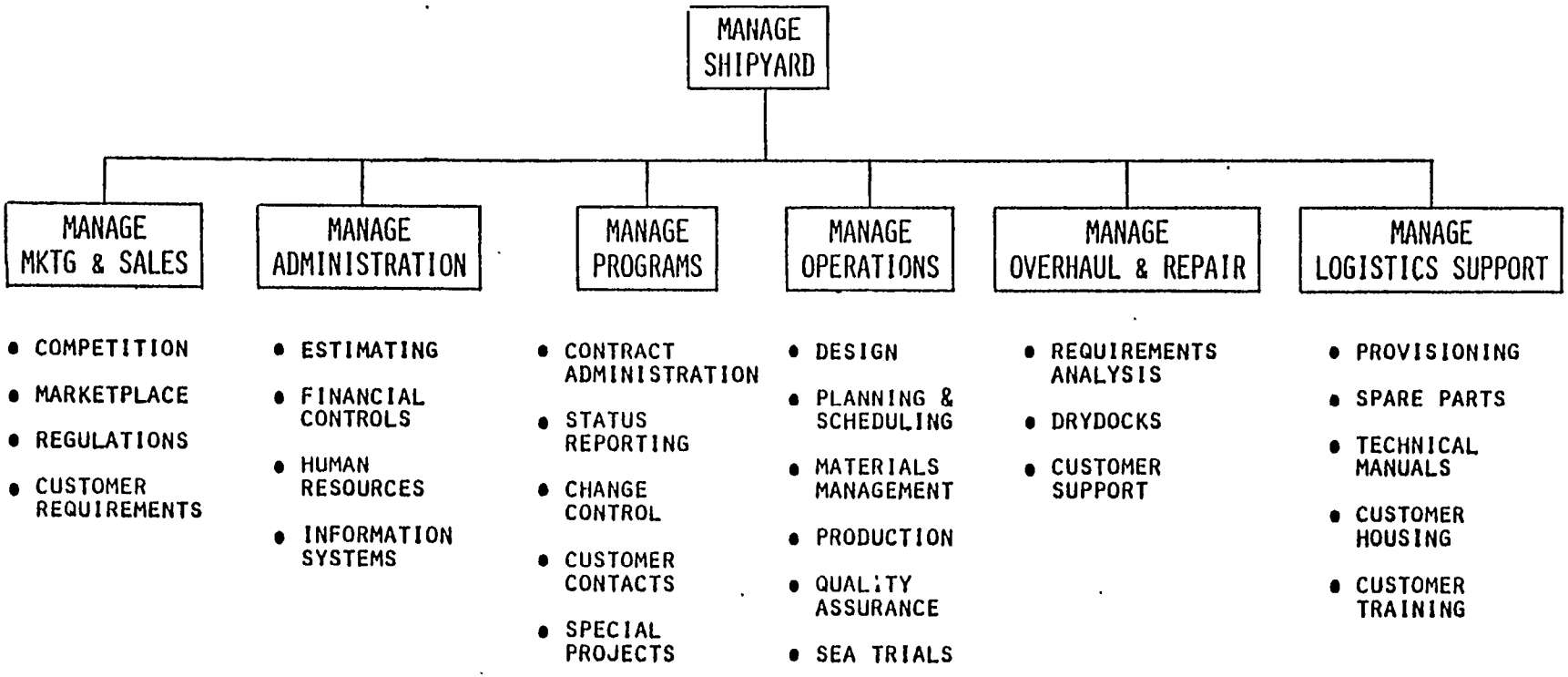
CIS FRAMEWORK

"WITHOUT SUCH AWARENESS WE WILL CONTINUE TO SUFFER FROM SUBOPTIMAL EFFORTS FROM WELL-INTENTIONED MANAGERS TRYING TO INCORPORATE NEW IDEAS PIECEMEAL FROM THE BOTTOM-UP WITHOUT ANY RECOGNIZED OVERALL FRAMEWORK FOR CHANGE."

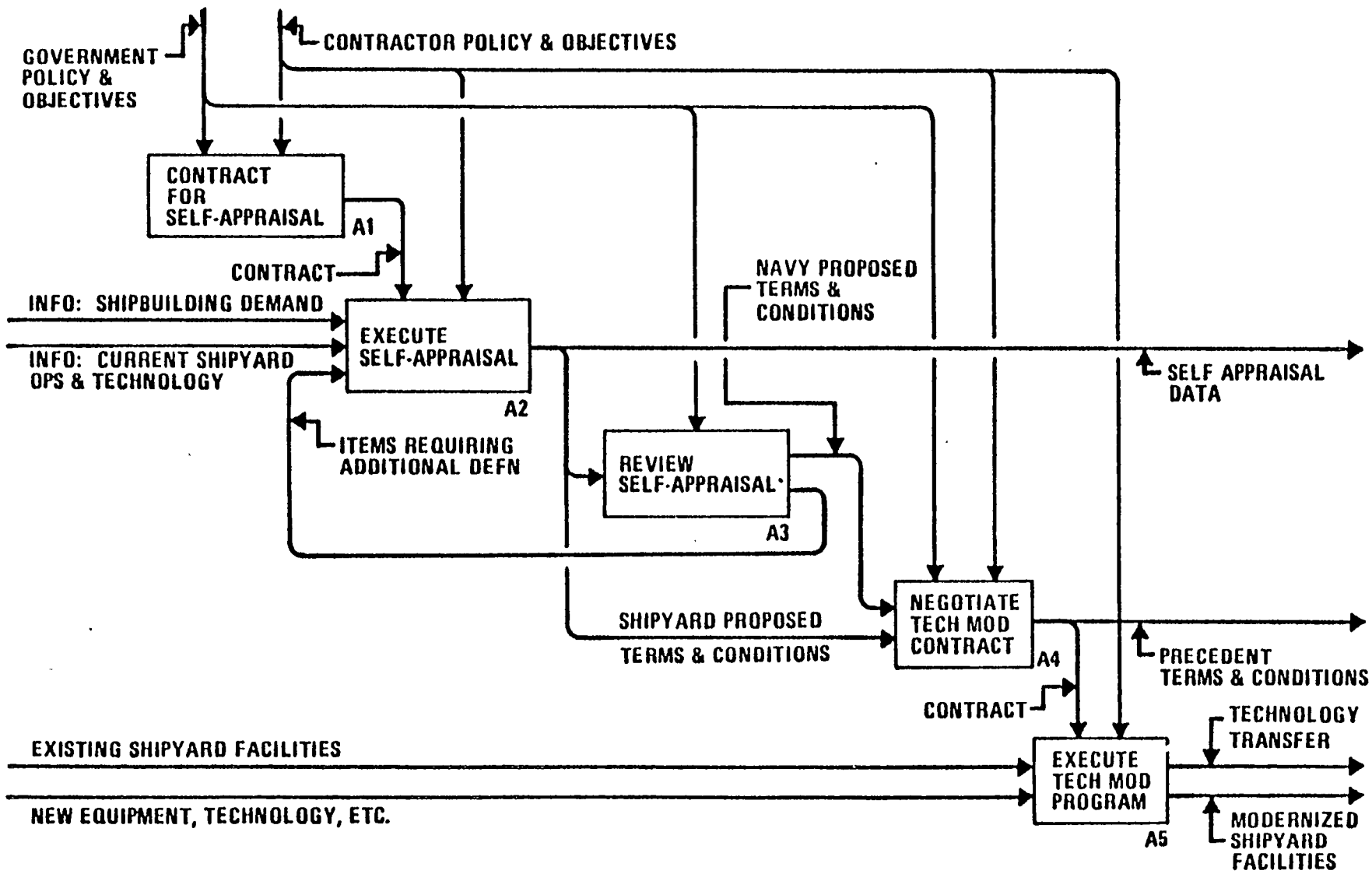
R. VORTMAN

NASSCO

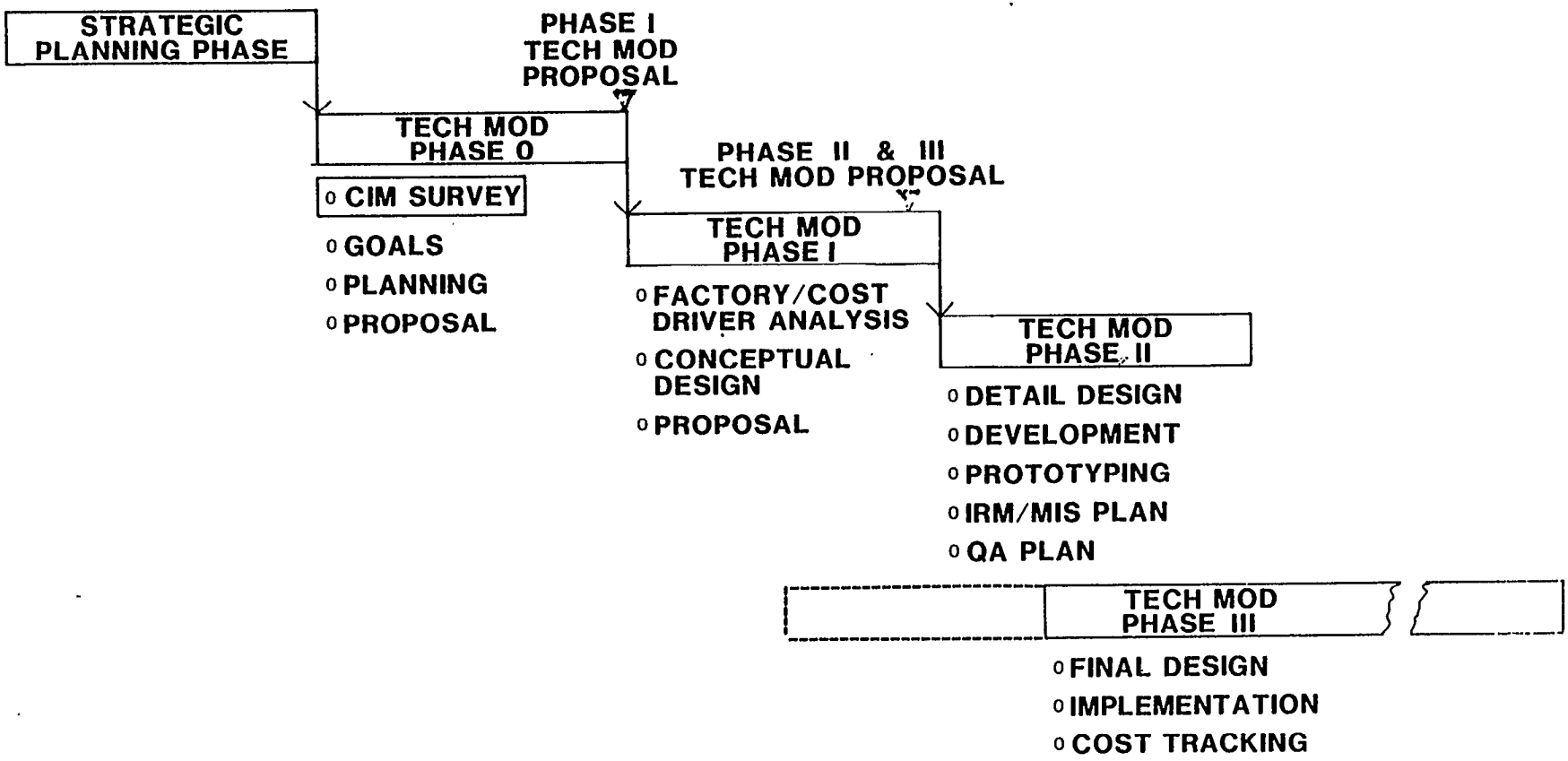
TASK WORK BREAKDOWN STRUCTURE (TWBS)



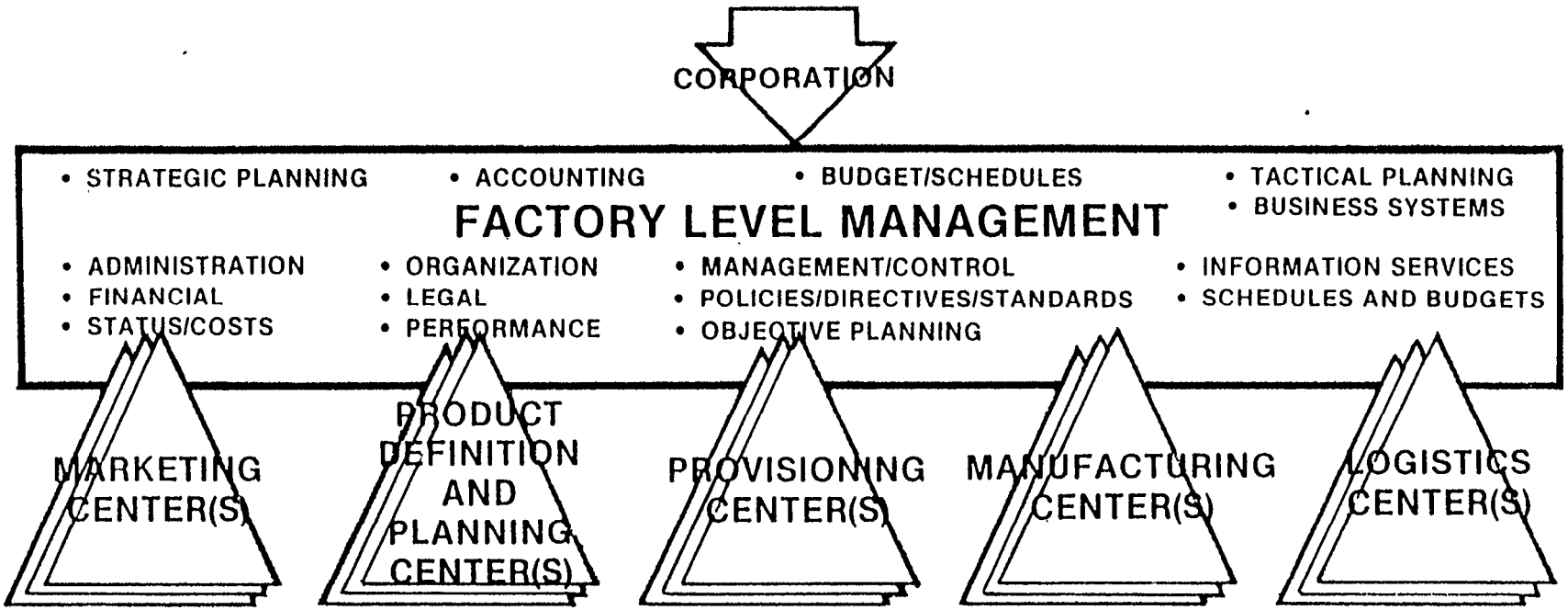
MANAGE TECHNOLOGY MODERNIZATION



TECHNOLOGY MODERNIZATION FRAMEWORK



FACTORY OF THE FUTURE FRAMEWORK



PROVIDE CUSTOMER LIAISON AND SERVICES
- PROPOSALS
- NEGOTIATION
- CONTRACT REPORTING
- WORK AUTHORIZATION
- CONTRACT MONITORING
- CUSTOMER CONTACT
- ORDER CHANGE/ CANCELLATION
- SCHEDULE/BUDGET TRACKING

ENGINEER AND PLAN PRODUCT
- ENGINEERING
- DESIGN
- GROUP TECHNOLOGY
- PRODUCIBILITY
- ANALYSIS
- MFG PLAN
- PROCESS PLAN
- MAKE OR BUY
- FLOW PLAN
- CAE
- CAD
- GPP

PROVIDE RESOURCES
- TOOLS
- FACILITIES
- EQUIPMENT
- PEOPLE
- INFORMATION/COMPUTER SYSTEMS
- MATERIAL
- MATERIAL HANDLING SYSTEM
- QA/QC

PRODUCE PRODUCT
- CONTROL MFG OPERATIONS
- PROCESSING
- STATUS REPORTING
- UNMANNED CELL
- MACHINE, MAN, MATERIAL STORES, ETC MONITORING
- NC
- DNC
- CNC
- AUTOMATED INSPECTION

PROVIDE LOGISTICS SUPPORT
- REQUIREMENTS
- DOCUMENTS
- SPARES/KITS, ETC
- FIELD SERVICE
- MAINTENANCE
- CUSTOMER TRAINING

PRODUCTIVITY "MYTHS"

- TOUCH LABOR CAUSES THE PROBLEM.
- COMPUTER'S AND PROCESS AUTOMATION WILL SOLVE THE PROBLEM.
- SHORT TERM RESULTS COUNT MOST.
- "FIRST LEVEL MANAGERS" AND "MID-MANAGERS" CAN SOLVE THE PROBLEM WITHIN THEIR AREAS OF ORGANIZATIONAL RESPONSIBILITY.

LOST PRODUCTIVITY

"AMERICAN WORKERS ACTUALLY ARE PRODUCING, ON AVERAGE, ONLY ABOUT 55% OF THE TIME THEY ARE ON THE JOB. THE RESULTING LOSS TOTALS 350 BILLION DOLLARS ANNUALLY."

T. BARRY & ASSOCIATES

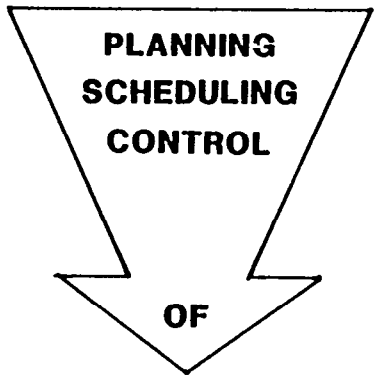
INDUSTRIAL ENGRG-NOV.'80

45%
OF DIRECT LABOR TIME IS NOT PRODUCTIVE

SOURCE

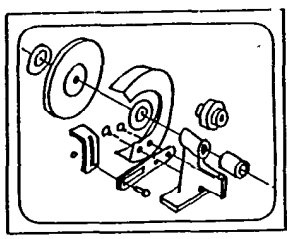
- 35% POOR SCHEDULING
- 25% POOR INSTRUCTIONS
- 15% INFLEXIBILITY
- 25% POOR MATERIAL FLOW

PAYOFF

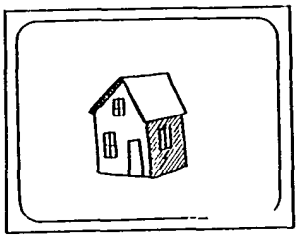


PEOPLE
MATERIALS
FACILITIES

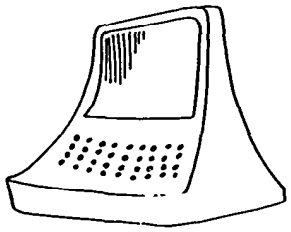
COMPUTER AIDED DESIGN



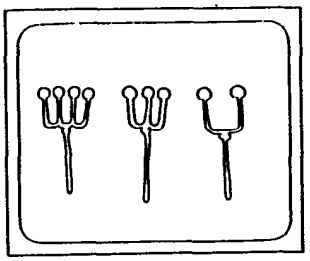
GEOMETRIC MODEL



HOLOGRAPH

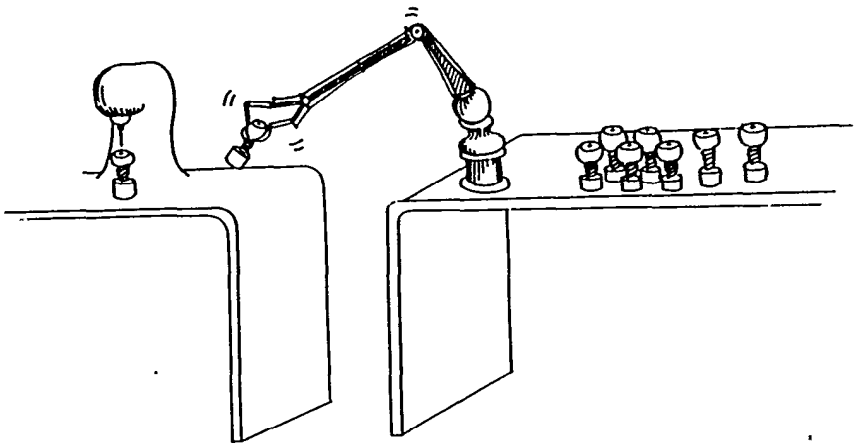


PERSONAL TERMINAL

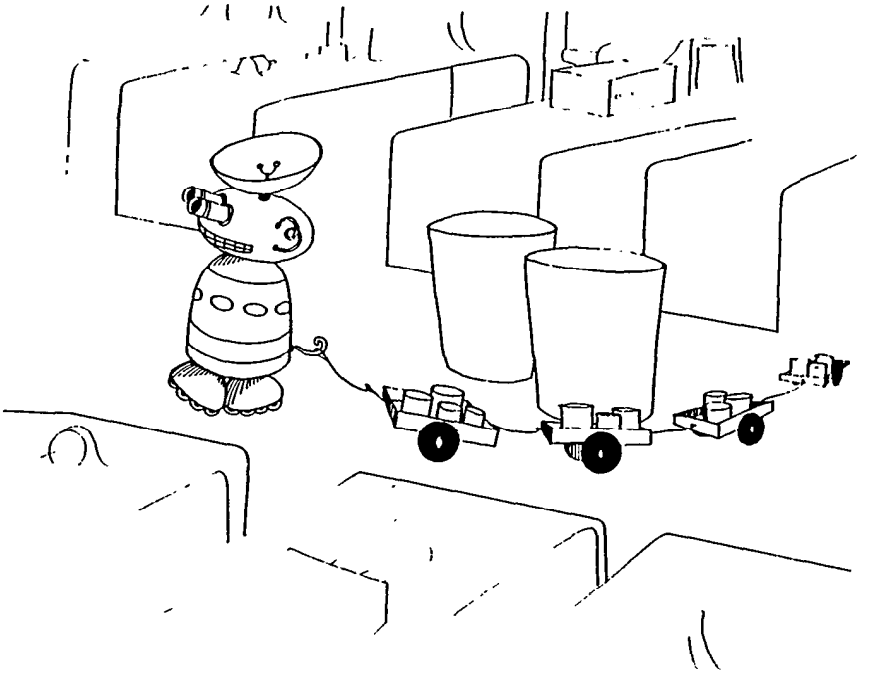


GROUP TECHNOLOGY

ROBOTICS



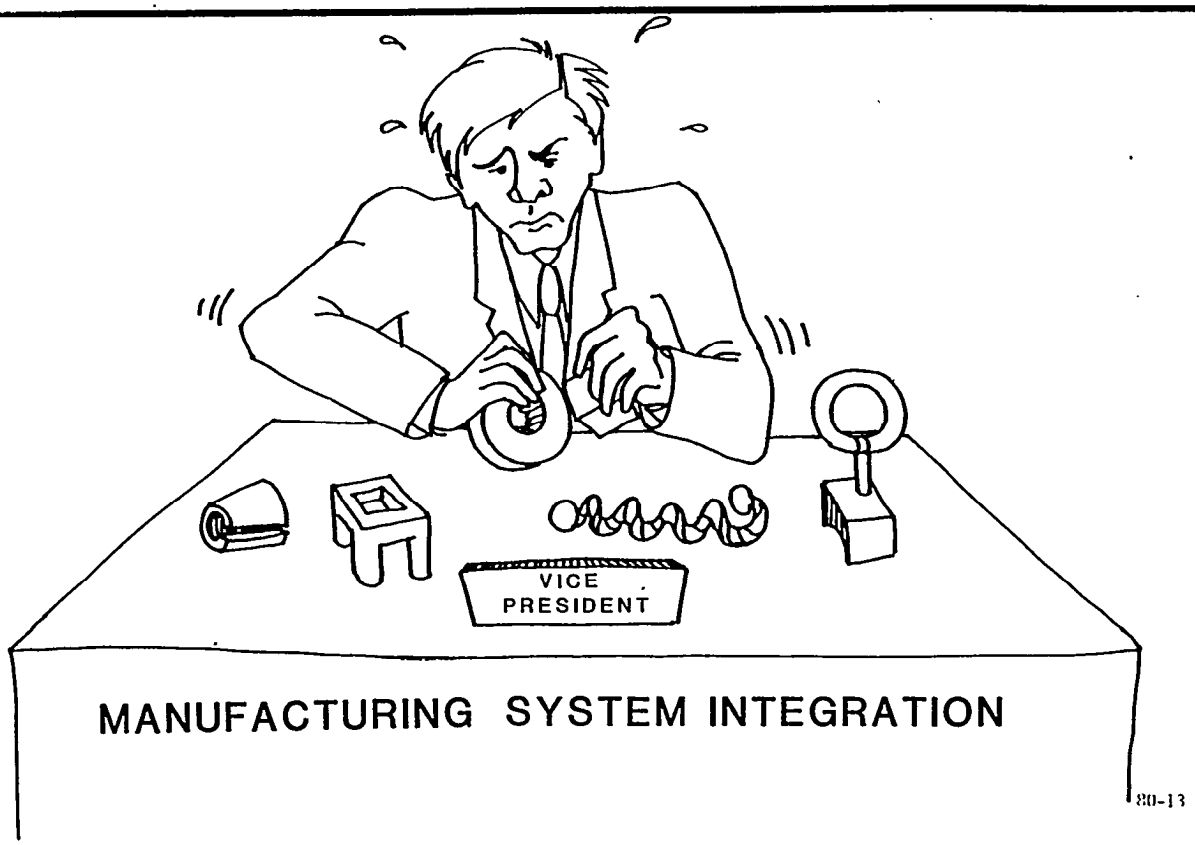
AUTOMATED MATERIAL HANDLING



THE LEMMING APPROACH TO AUTOMATION

80-11

[C] OMPUTER [I] NTEGRATED [M] ANUFACTURING



PRODUCTIVITY "DISCOVERIES"

- ADEQUATE TECHNOLOGY IS AVAILABLE
- MANAGERIAL EMPHASIS MUST SHIFT
- LONG TERM IMPLEMENTATION STRATEGY REQUIRED
- INTEGRATED IMPLEMENTATION IS THE KEY
- CONCEPTUAL INTEGRATED SYSTEMS ARCHITECTURE/FRAMEWORK NEEDED FOR PLANNING
- [I]NFORMATION [R]ESOURCE [M]ANAGEMENT (IRM) DEPENDENT UPON [C]OMPUTER [B]ASED [I]NFORMATION [S]YSTEM (CBIS) WITH NEUTRAL DATA STRUCTURE

71 38

CHANGING THE FOCUS

- EMPHASIZE INTEGRATION OF MANUFACTURING ACTIVITY VERSUS SPECIALIZATION.
- REFOCUS MANAGEMENT ATTENTION FROM MANUFACTURING TECHNIQUES TO MANUFACTURING SYSTEMS.
- FACE AND RESOLVE NEED FOR MANAGEMENT ORGANIZATION RESTRUCTURING

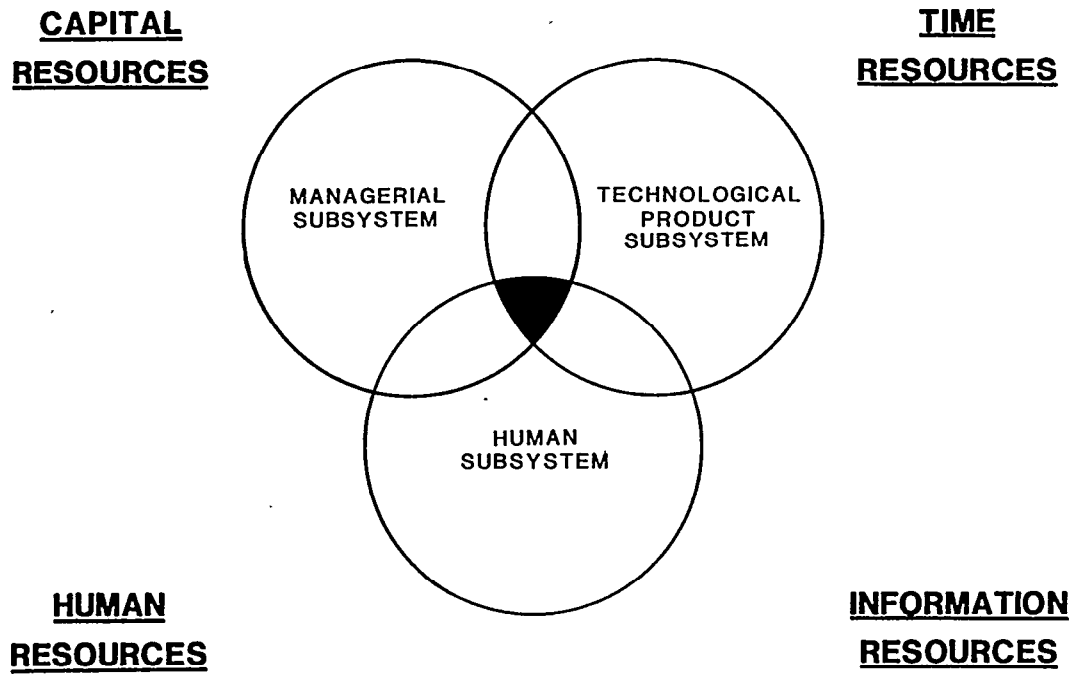
JIM LARDNER
DEERE&CO.

INTEGRATED STRATEGIC PLANNING AND IRM

- "ONLY 19% OF THE COMPANIES SURVEYED HAVE INTEGRATED THEIR STRATEGIC PLANNING AND INFORMATION RESOURCE MANAGEMENT (IRM) SYSTEMS"
- "THE COMPANIES THAT DID SO OUTPERFORMED THE REST OF THE SAMPLE BY ABOUT 300% OVER FIVE YEARS ON SUCH MEASURES AS :
  - AVERAGE RETURN ON EQUITY
  - RETURN ON TOTAL CAPITAL
  - NEW PROFIT MARGINS"

(REF: A.T. KEARNEY. INC, MANAGEMENT CONSULTANT SURVEY OF 40 OF 500 LARGEST U.S. INDUSTRIAL AND FINANCIAL INSTITUTIONS)

RESOURCE MANAGEMENT

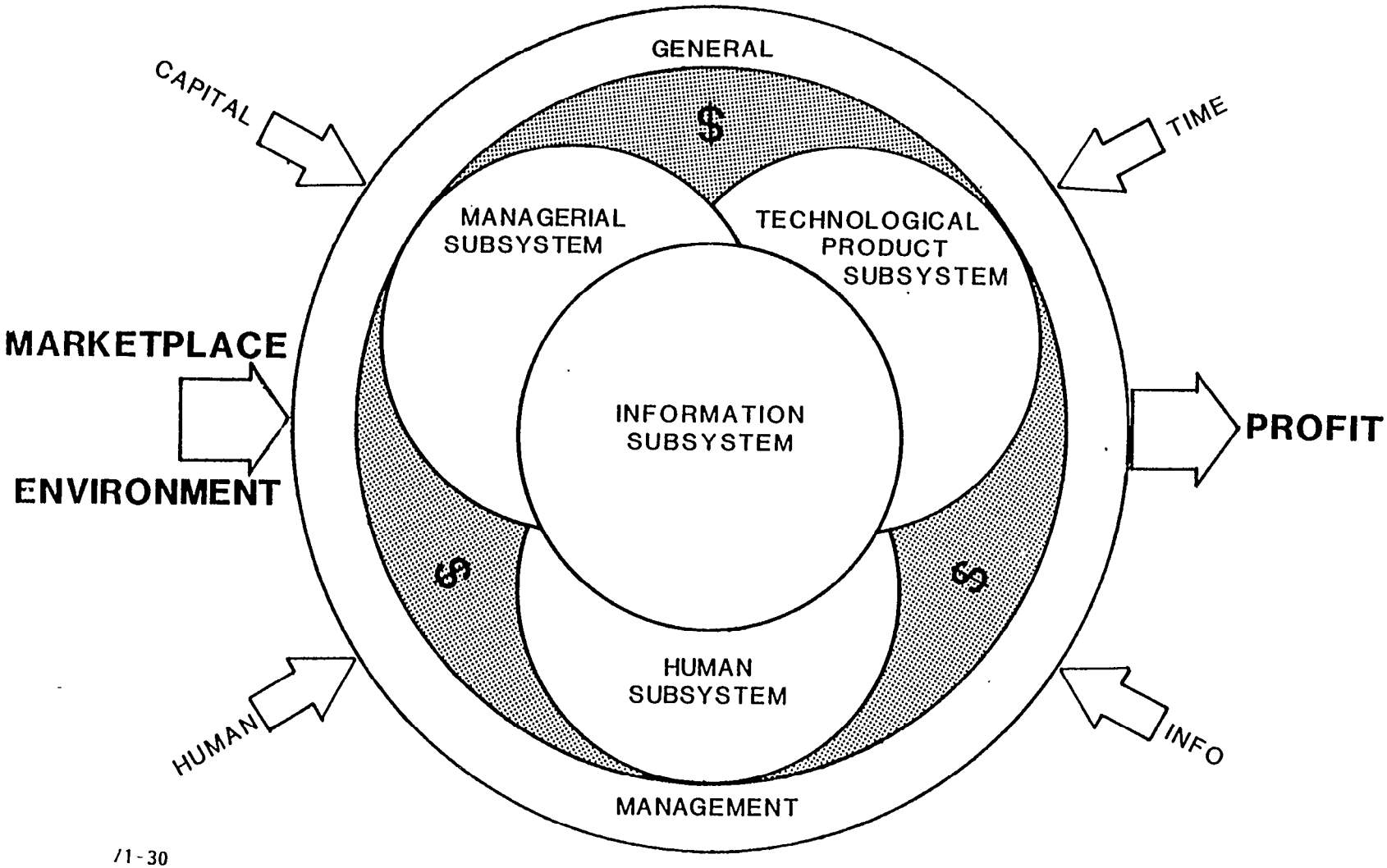


INFORMATION RESOURCE MANAGEMENT (IRM)

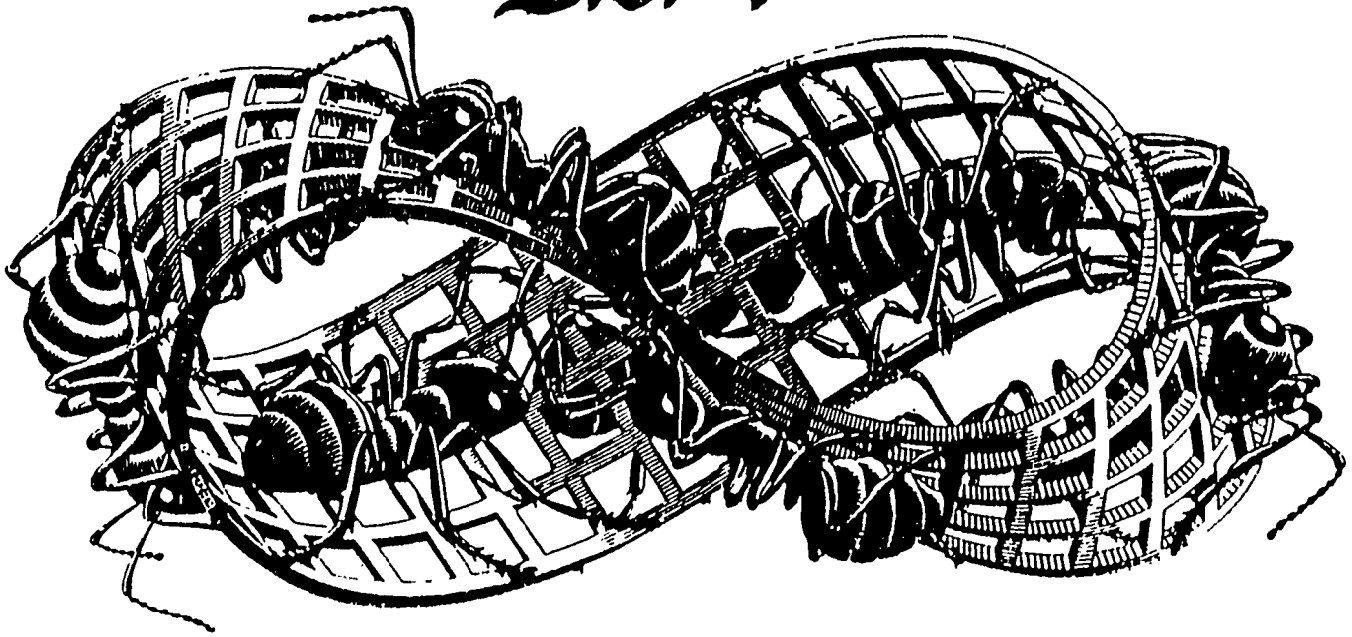
"INFORMATION IS THE MANAGER'S MAIN TOOL,. INDEED THE MANAGER'S 'CAPITAL", AND IT IS HE WHO MUST DECIDE WHAT INFORMATION HE NEEDS AND HOW TO USE IT."

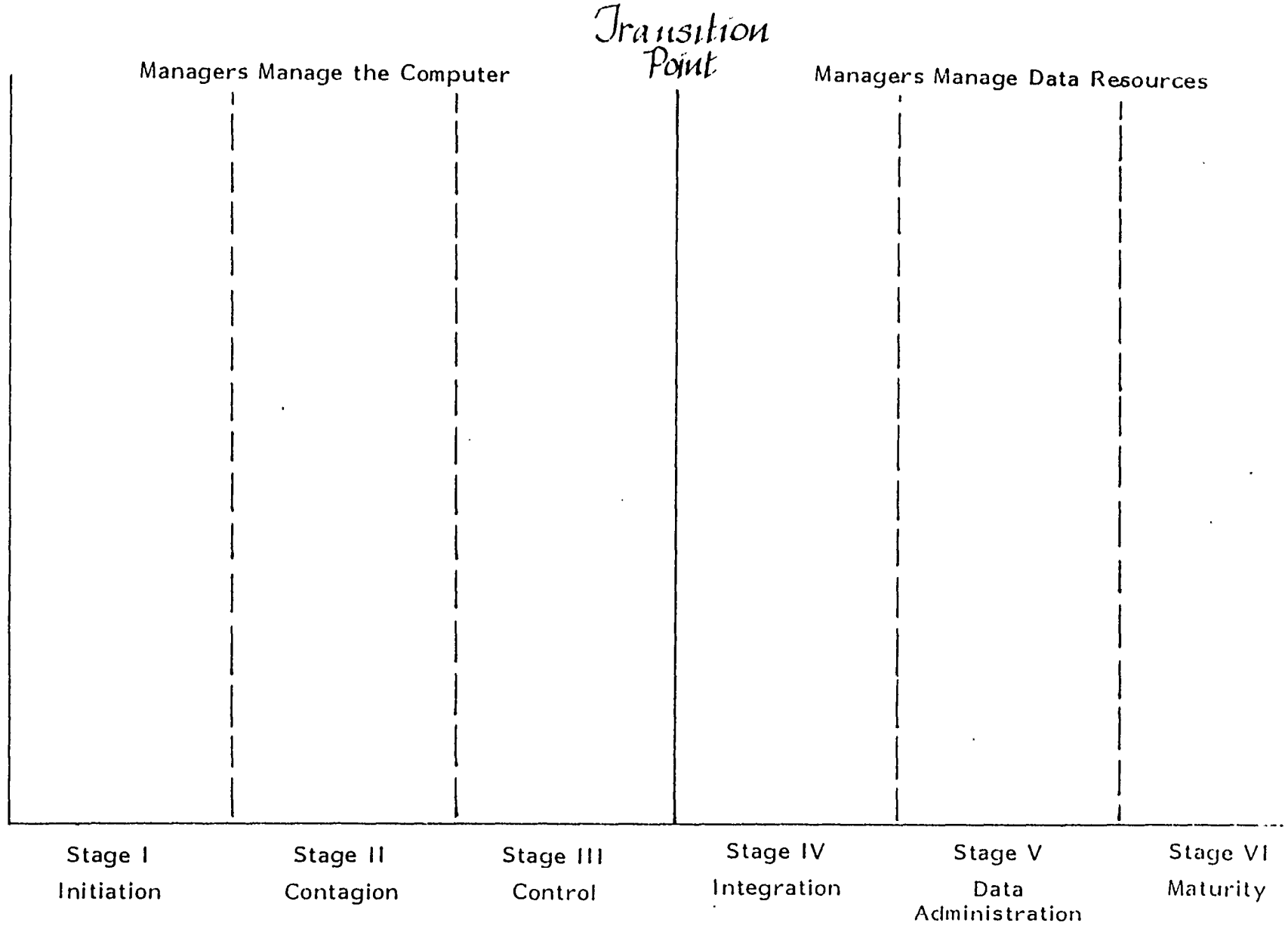
PETER DRUCKER-"MANAGING THE INFORMATION EXPLOSION'

INFORMATION RESOURCE MANAGEMENT



Managing The Transition From Data Processing to IRM




Transition Point
Managers Manage the Computer
Managers Manage Data Resources
Stage I
Initiation
Stage II
Contagion
Stage III
Control
Stage IV
Integration
Stage V
Data Administration
Stage VI
Maturity

Nolan Scale

Architecture = Structure Specification

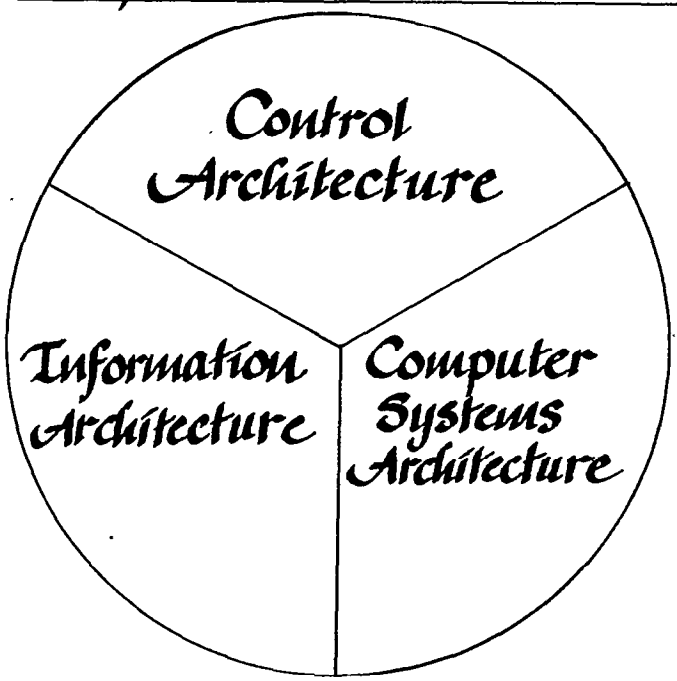
Specifies:

- Components
- Logical Relationships
- Uses

Reflects:

- Philosophy
- Technique

Information Resource Component Architectures



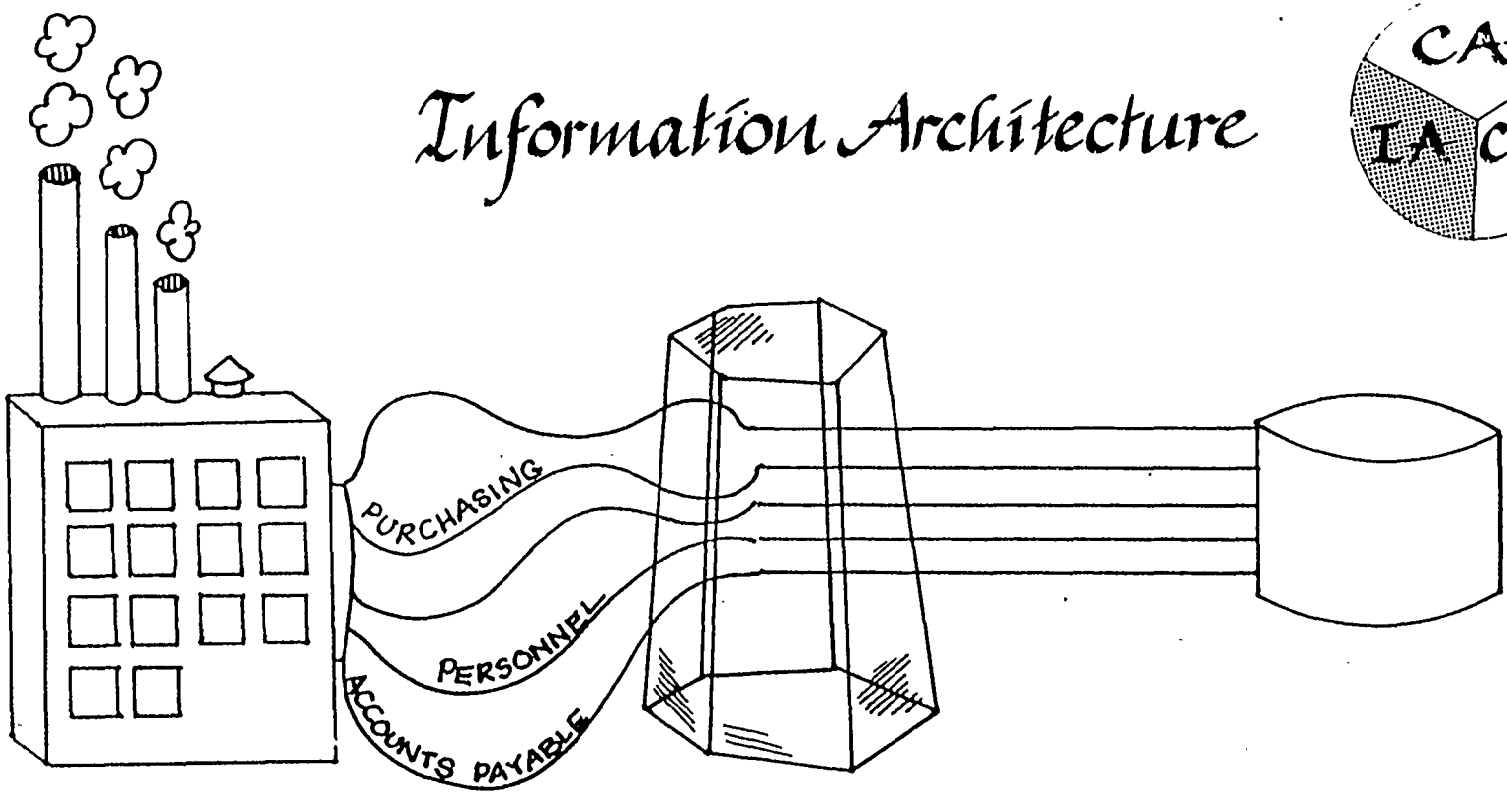
DATA DRIVEN IRM ARCHITECTURE

- INFORMATION ARCHITECTURE (IA)
  - DATABASES
  - APPLICATIONS
  - INPUT PROCESSES
  - OUTPUT PROCESSES
- CONTROL ARCHITECTURE (CA)
  - STANDARDS & PROCEDURES
  - SYSTEMS ENGINEERING METHODOLOGY
  - INTEGRATED NEUTRAL DATA STRUCTURE
  - ORGANIZATION & TEAMS
  - PLANS & CONTRACTS

DATA DRIVEN IRM ARCHITECTURE (CONTINUED)

- COMPUTER SYSTEMS ARCHITECTURE (CSA)
  - HARDWARE
  - COMMUNICATIONS
  - SYSTEMS SOFTWARE
  - TOOL KITS

Information Architecture



External Schema (User Views)

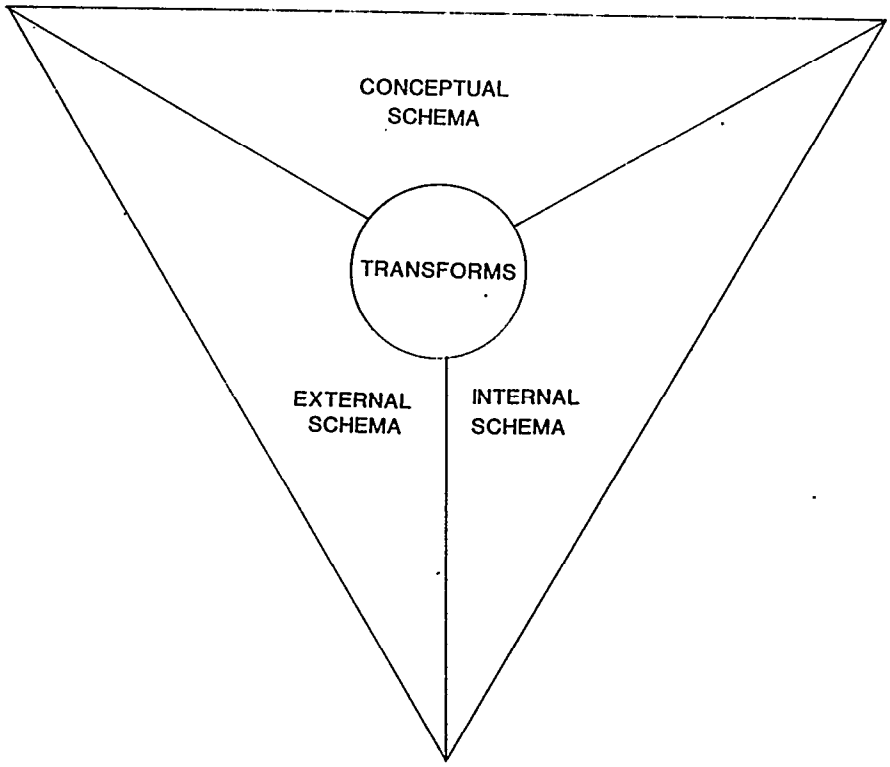
Conceptual Schema (Logical data base design)

Internal Schema (physical implementation)

(ANSI/X3/SPARC - Three Schema Architecture

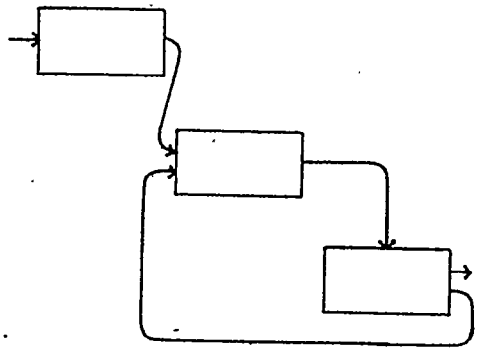
72-12

ROSETTA STONE

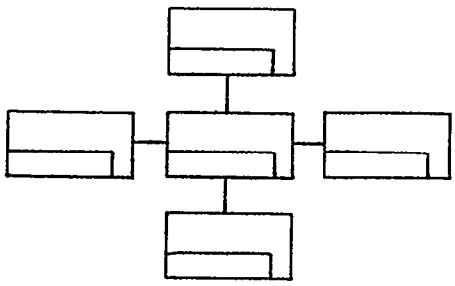


Information Architecture

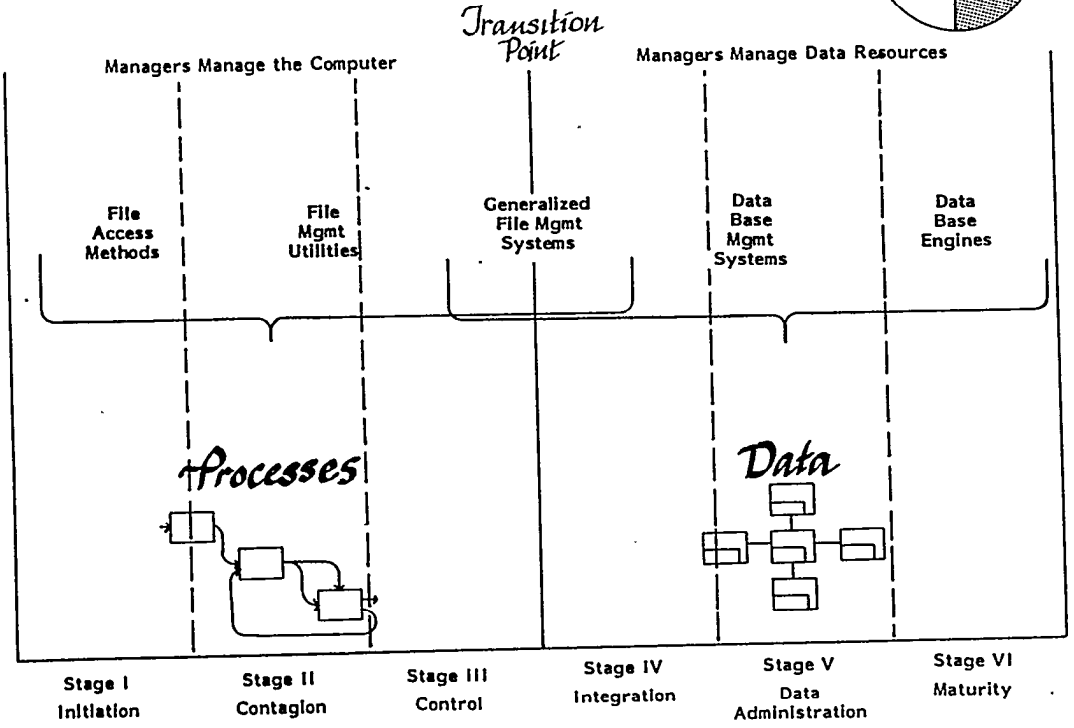
Processes



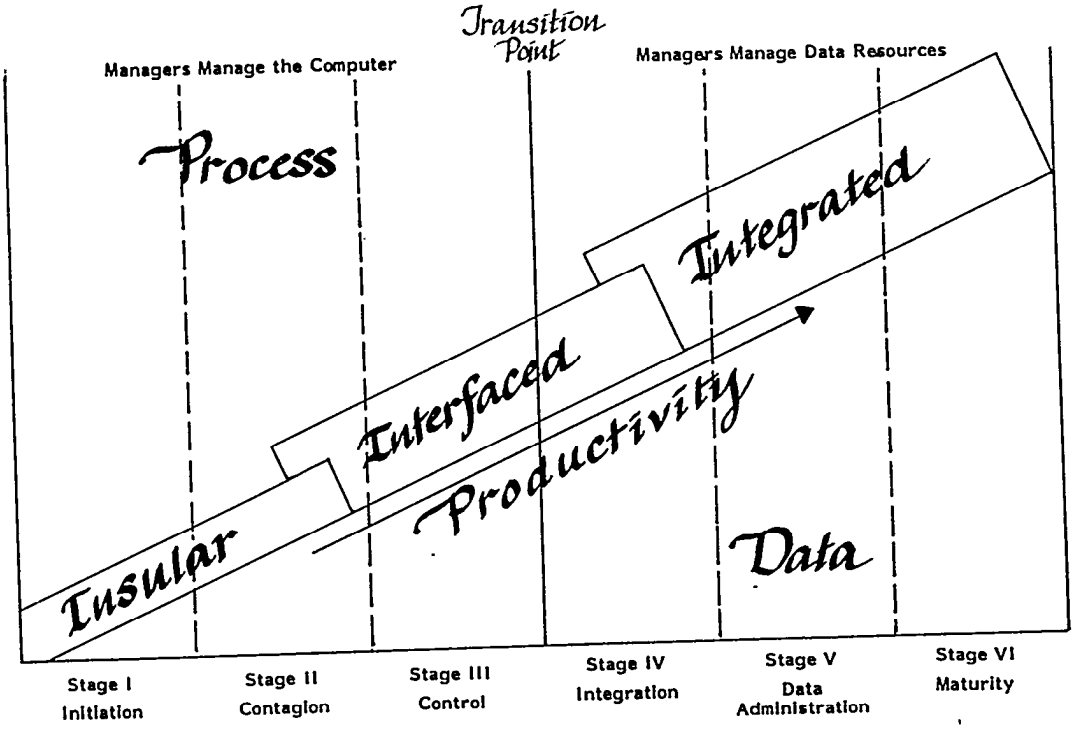
Data



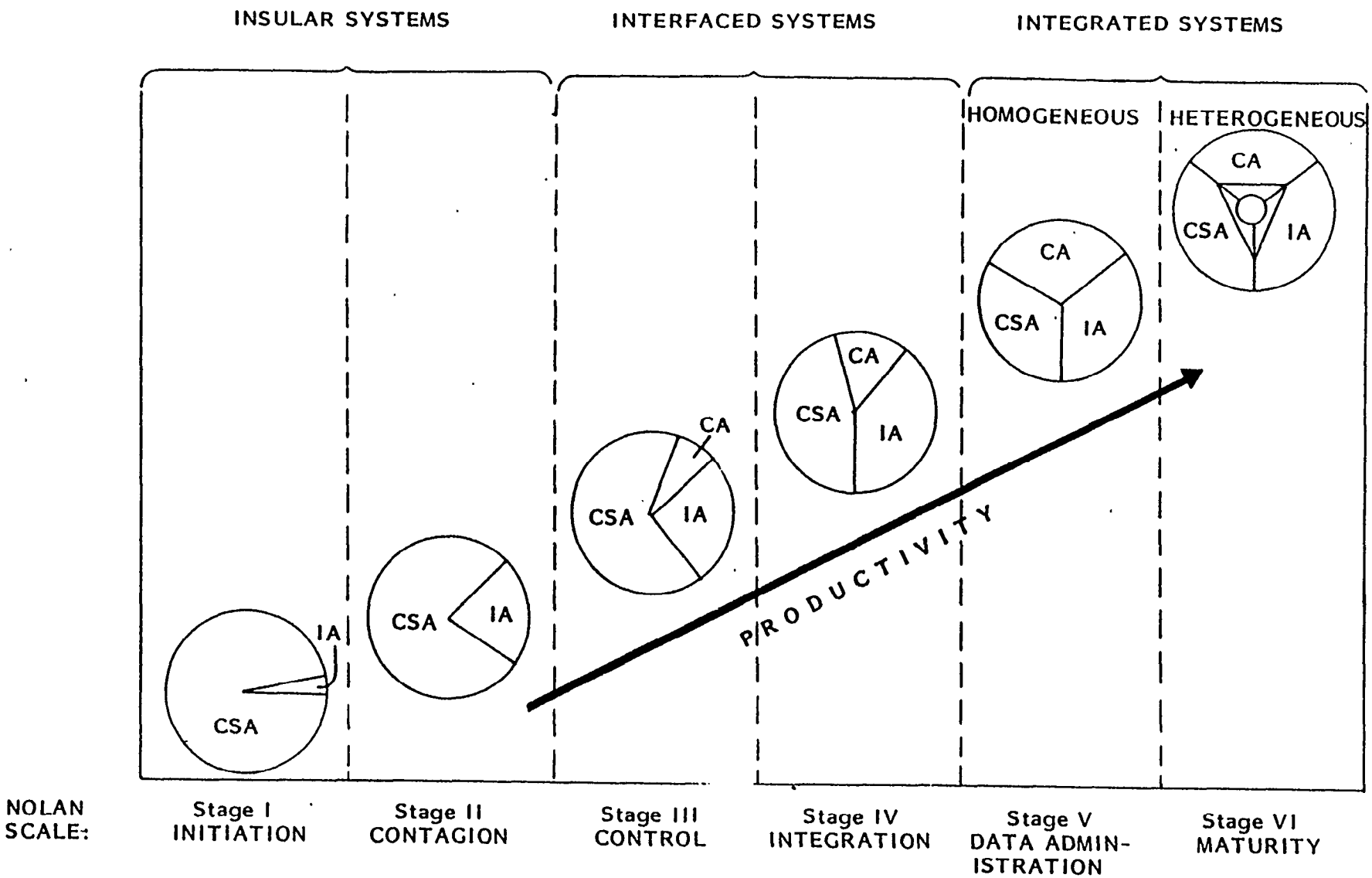
Computer Systems Architecture



Nolan Scale



Nolan Scale

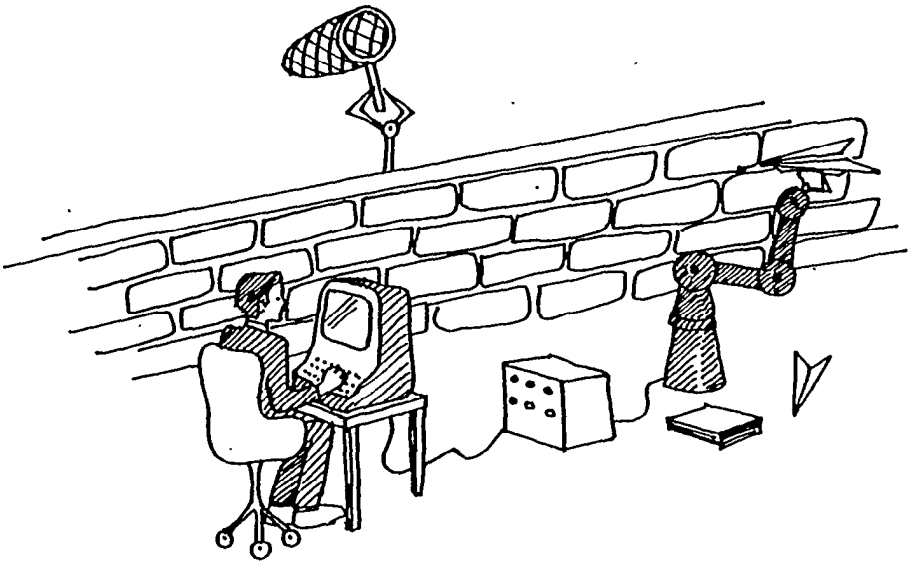


BALANCING THE ARCHITECTURES
AND ACHIEVING INTEGRATION

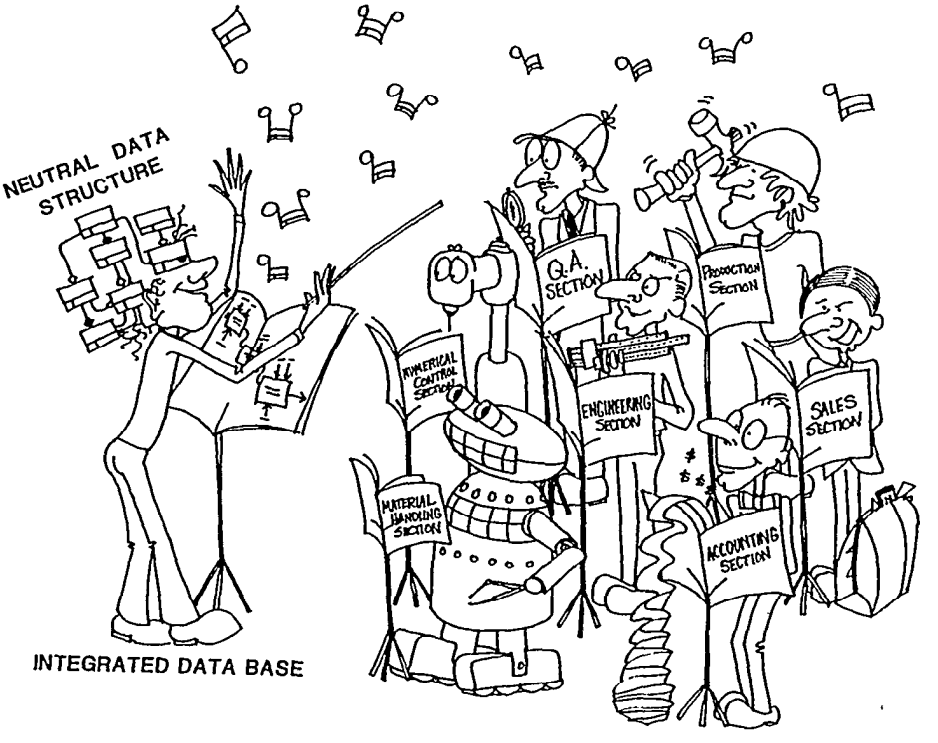
THE OLD WAY

THE NEW WAY

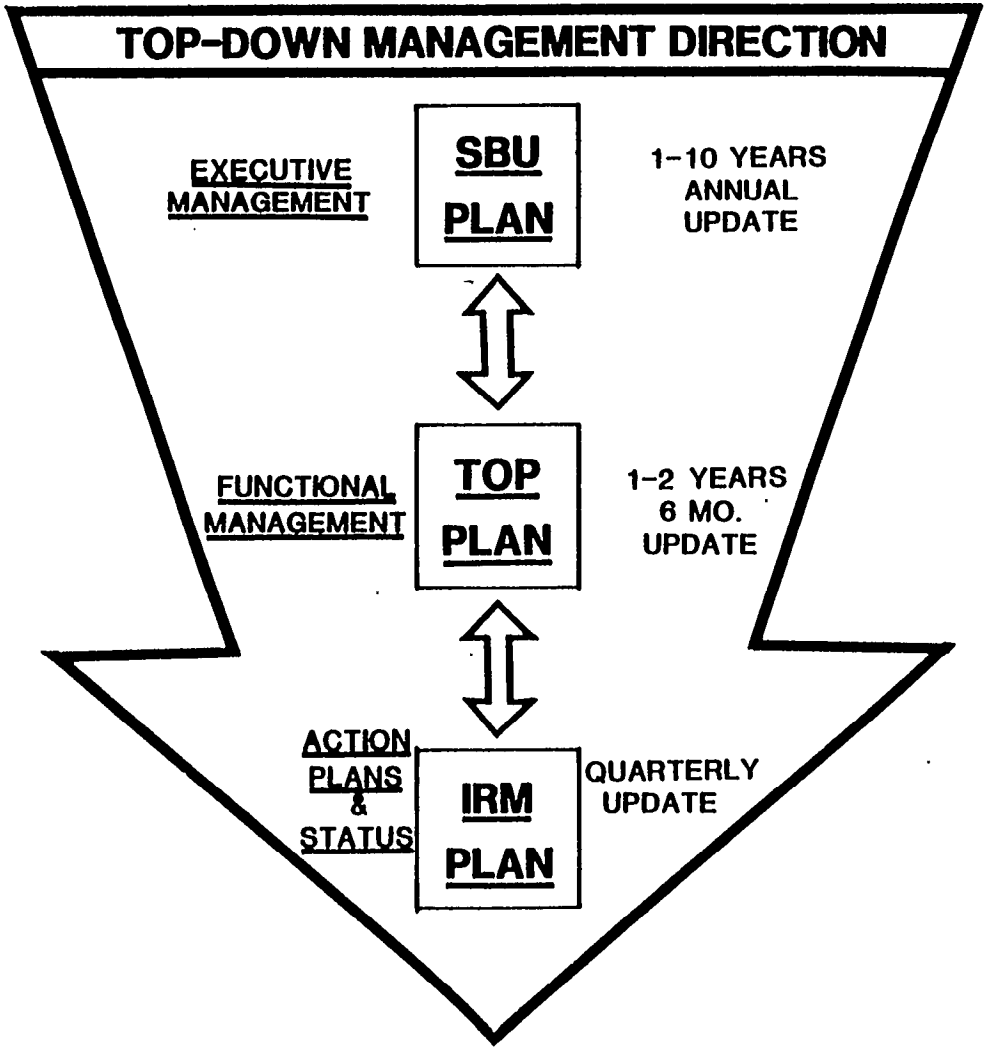
THE WRONG WAY



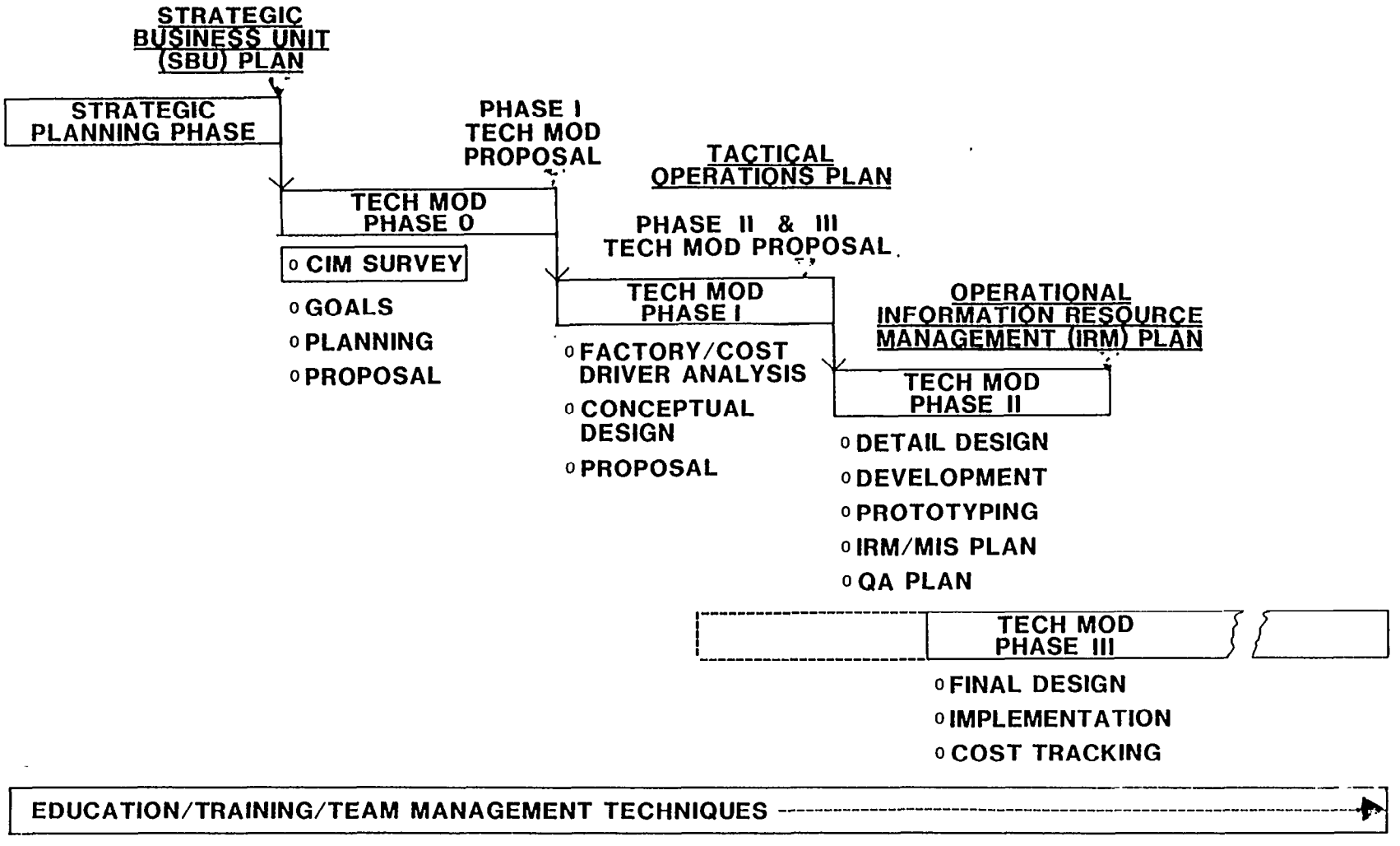
INFORMATION RESOURCE MANAGEMENT (IRM)



INFORMATION RESOURCE MANAGEMENT PROGRAM



TECHNOLOGY MODERNIZATION FRAMEWORK



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"TOP-DOWN" PROGRAM MANAGEMENT/"BOTTOM-UP" PRO.IECT IMPLEMENTION

MANAGING CIM FOR TOMORROW

"IN TURBULENT TIMES, MANAGERS CANNOT ASSUME TOMORROW WILL BE AN EXTENSION OF TODAY. ON THE CONTRARY, THEY MUST MANAGE FOR CHANGE; CHANGE ALIKE AS AN OPPORTUNITY AND A THREAT."

PETER DRUCKER-"MANAGING IN TURBULENT TIMES"

COMPUTER INTEGRATED SHIPBUILDING

- COMMON TERMINOLOGY & CONCEPTS
- PRODUCTIVITY "MYTHS" AND "'DISCOVERIES"
- CHANGING MANAGEMENT FOCUS
- INFORMATION RESOURCE MANAGEMENT (lRM)
- DATA DRIVEN IRM ARCHITECTURE
- MANAGING CIS FOR TOMORROW